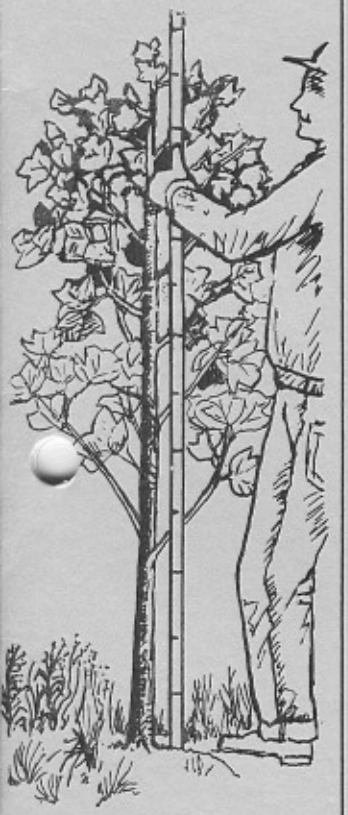

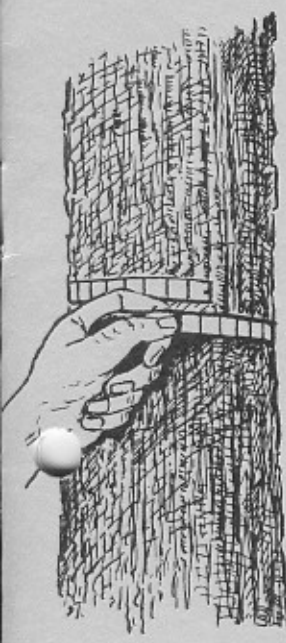

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LOBLOLLY PINE RELEASE STUDY

REPORT NUMBER

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VIRGINIA DIVISION OF FORESTRY

Department of Conservation and Historic Resources

LOBLOLLY PINE RELEASE
Report #3

by
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Abstract. This study included three treatments: no release, hand-chopping hardwoods close to the ground, and mist-blowing with a backpack mist-blower. The release was done during the second growing season. Hardwood competition was fairly severe at time of release. At age 19, hand-chopped plots averaged 63 percent more basal area and 80 percent more volume in standard cords than the check plots, and the mist-blown plots averaged 29 percent more basal area and 25 percent more volume than the check plots.

INTRODUCTION

This is the third in a series of Occasional Reports concerning release of loblolly pine seedlings from hardwood competition. This particular study was installed in the south central Piedmont of Virginia on the Prince Edward State Forest, in Stand 16 of the Gallion 2 Management Unit. The previous stand of mostly mixed hardwoods, with some scattered pine, had been cut during the winter of 1965-66. The only site preparation was poisoning of residual hardwoods. Loblolly pine seedlings were planted in the spring of 1966.

On June 27, 1967, during the second growing season, a Solo backpack mist-blower was used to apply two pounds active ingredient of 2,4,5-T per acre on part of the area. On August 7, another part of the area was released by chopping off all hardwoods close to the ground. A check area was left untreated. Three years later, on August 5, 1970, the few residual hardwoods that survived initial treatment were retreated. Figure 1 shows the layout of treatment areas and permanent growth plots.

In April, 1968, mil-acre sample plots were systematically located in the treatment areas. Height of each loblolly pine was measured to the nearest one-half foot. One hundred plots were located in the check area, 60 in the mist-blown area, and 50 in the hand-chopped area. Estimates of loblolly pine stocking and average heights based on this mil-acre sampling, are shown in Table 1.

Competition from hardwood sprouts varied over the study area, but generally was fairly severe. The check and mist-blown areas had similar hardwood competition, with chestnut oak stump sprouts by far the most serious competitors. The hand-chopped area was different, especially on the south end. Hand-chopped plots 1 and 2 are slightly lower in elevation, and the site, judged by hardwood species present, is more moist. There was more red maple, yellow-poplar, and sweet gum on these plots, and much less chestnut oak. Early competition was more severe on the hand-chopped area when the study was installed, because there were more hardwood stems, and the lower pine stocking (Table 1) was probably a result of this greater early competition.

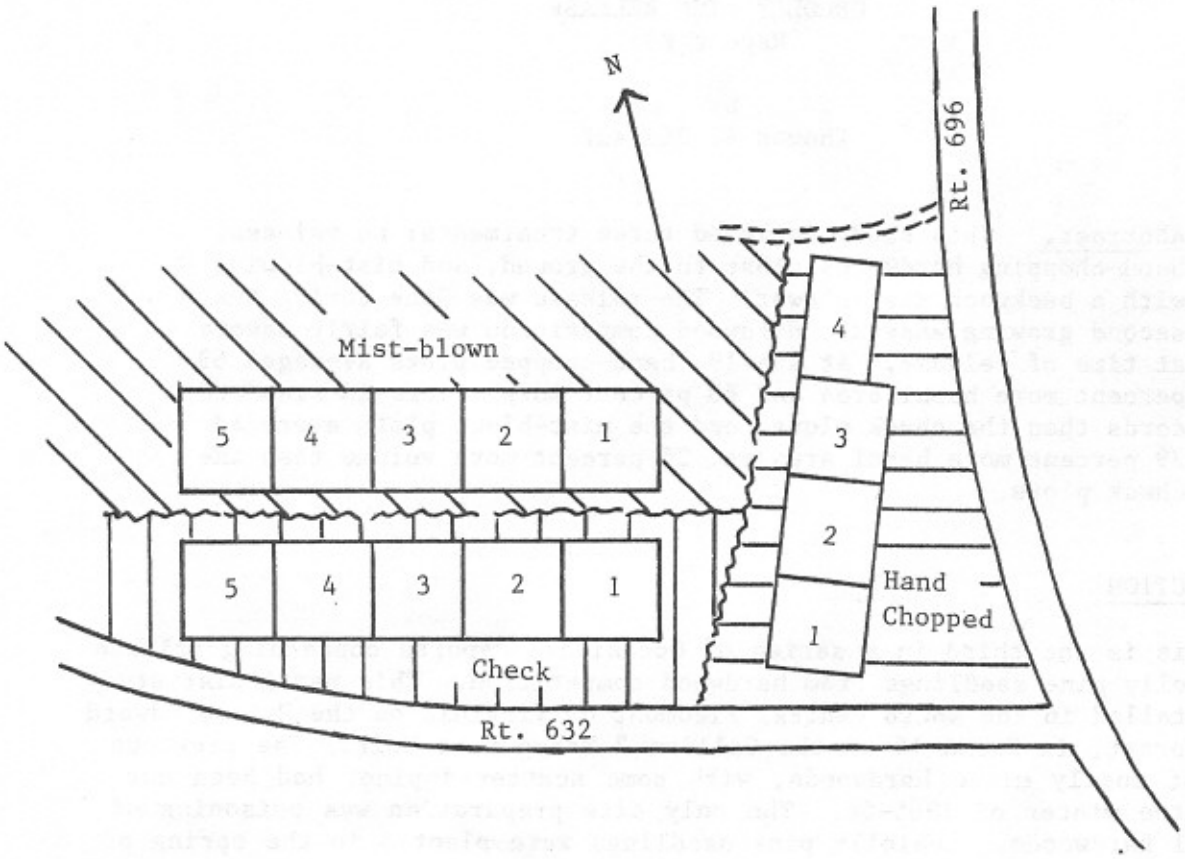

FIGURE 1. Layout of study and growth plots.

TABLE 1. Number and height of loblolly pine seedlings two seasons after planting.

Treatment	Number per acre	Height (feet) Average	Range
Check	750	2.9	1/2 to 5-1/2
Mist-blown	770	3.1	1 to 5-1/2
Hand-chopped	560	2.8	1 to 4-1/2

GROWTH PLOT INSTALLATION

In December, 1974, after nine growing seasons, permanent one-tenth acre growth plots were installed. Fourteen plots were installed, five each in the check and mist-blown areas and four in the hand-chopped area. Plots are one chain square, except hand-chopped plot 4, which is 3/4 by 1-1/3 chains (Figure 1). All volunteer pines (mostly Virginia pine, but some shortleaf pine) were cut down at this time.

In February, 1976, after ten growing seasons, the plots were measured for the first time, and were remeasured at ages 15 and 19. All three measurements included DBH of each loblolly pine to the nearest inch and total heights to the nearest foot of a sample of trees in each diameter class, noting which trees were dominant or codominant. The final measurement included a tally of all hardwoods over .5 inch DBH by species, DBH and crown class, and total heights to the nearest foot of about half of the hardwoods in the codominant and dominant crown classes.

RESULTS AND DISCUSSION

A summary of loblolly pine data for the three measurements is presented in Table 2, and individual plot data for each measurement in Appendix A. At age 19, mist-blown plots averaged 3.0 and hand-chopped plots 9.7 standard cords more than the check plots.1/ Differences due to release increased with time (Table 3). Table 4 presents stand tables for loblolly pine at age 19.

TABLE 2. Average loblolly data: number per acre, DBH, basal area per acre, standard cords per acre, and height of dominant and codominant trees at ages 10, 15, and 19.

	Check			Mist-blown			Hand-chopped		
	10	15	19	10	15	19	10	15	19
Number	552	424	386	654	554	514	505	480	455
DBH	3.03	4.36	5.10	3.44	4.65	5.24	4.30	5.64	6.34
Basal Area	35.5	53.8	66.4	48.0	72.3	85.4	55.5	90.0	108.0
Std. Cords	-	6.8	12.1	-	9.2	15.1	-	13.6	21.8
Height	30.2	40.9	48.8	31.1	41.3	48.9	31.0	41.6	49.4

TABLE 3. Average differences between released plots and check plots at each measurement, for basal area per acre and standard cords per acre.

	Mist-blown minus Check		Hand-chopped minus Check	
Age	Basal Area	Std. Cords	Basal Area	Std. Cords
10	12.5	--	20.0	--
15	18.5	2.4	36.2	6.8
19	19.0	3.0	41.6	9.7

1/ Standard cords at age 19 were subjected to an analysis of variance. Differences between treatment means were tested using Duncan's New Multiple Range Test. At the .05 level, hand-chopping yields were significantly greater than check, but not mist-blown yields.

TABLE 4. Average number of loblolly pines per acre by DBH class at age 19.

DBH	Check Plots	Mist-blown Plots	Hand-chopped Plots
1	18		
2	18	22	2
3	52	58	25
4	38	80	60
5	74	104	55
6	66	140	98
7	74	70	90
8	34	34	66
9	12	4	44
10		2	15
Totals	386	514	455

A summary of hardwood data from the final measurement at age 19 is presented in Tables 5 and 6.

The check and mist-blown areas were similar when the study was installed (about the same number of loblolly seedlings and similar hardwood competition) and so the differences at age 19 should reflect primarily the effect of mist-blowing. The difference in yield at age 19 was only three cords. The disappointing gain from mist-blowing is primarily due to very aggressive chestnut oak sprouts. Many of these sprouts were well above head high when mist-blown early in the second season. They recovered rapidly, and many have grown fast enough to maintain a position in the canopy. On the mist-blown plots there is an average of 28.7 square feet of hardwood basal area in intermediate, codominant and dominant trees, which is almost as much as the average of 33.5 square feet on the check plots.

The hand-chopped plots were different initially (fewer pine seedlings and a different kind of hardwood competition). Hand-chopping was more effective than mist-blowing in reducing the numbers of hardwoods that remained in the canopy. At age 19, an average of only 13.6 square feet of hardwood basal area was in intermediate, codominant, or dominant trees. Had there been as many loblolly seedlings present on hand-chopped plots as on the other plots when the study was installed, the difference in pine volume between hand-chopping and the other two treatments would have been greater.

Following site preparation and planting, hardwood sprouts usually get off to a much faster start than pine seedlings. Hardwood sprouts usually grow very rapidly the first season or two, and then slow down during succeeding seasons. Pine seedlings, on the other hand, usually grow slowly the first season and then speed up in succeeding seasons until, by the third or fourth season, if they have not been seriously over-topped, they are usually growing more rapidly than most hardwoods. As a result, pine seedlings that start out shorter than hardwood sprouts after the first season, catch up with and over-top most hardwoods as time goes by. How long it takes for pine seedlings to over-top hardwoods depends on several factors, such as degree of site preparation, thoroughness of hardwood release, site quality, initial

vigor of pine seedlings, and species of hardwoods present. There is a lot of variation among hardwood species in rates of initial and long-term height growth. On average sites in piedmont Virginia, chestnut oak and scarlet oak are particularly aggressive, and if not controlled, they sometimes grow fast enough to maintain a place in the final canopy. Species like dogwood and black gum, on the other hand, can provide serious competition for a few years, but fall behind rapidly into an understory position.

At age 19, the average dominant and codominant hardwoods on the check and mist-blown areas are only about three feet shorter than the dominant and codominant loblolly pines (Table 7). It is unlikely that the pines will ever over-top all of these hardwoods, and the final stand will probably be a mixed stand, with pine predominating. The hardwoods that will probably maintain a position in the canopy are all chestnut oak and scarlet oak. On the hand-chopped area, in addition to chestnut oak and scarlet oak, there may also be a few yellow poplar.

Differences in cordwood yields at age 19 are related to the amount of hardwood present at that age. Figure 2 shows pine cordwood yields relative to basal area of dominant, codominant and intermediate hardwoods at age 19, for the 14 plots. The simple linear regression fitted to these data accounted for 74 percent of the variation in cordwood yields.1/ A regression of yields over total hardwood basal area (all trees over ½-inch DBH) accounted for only 39 percent of the variation in yields. Hardwoods that were overtopped by age 19 had less effect on pine yields than hardwoods that were still competing for crown growing space.

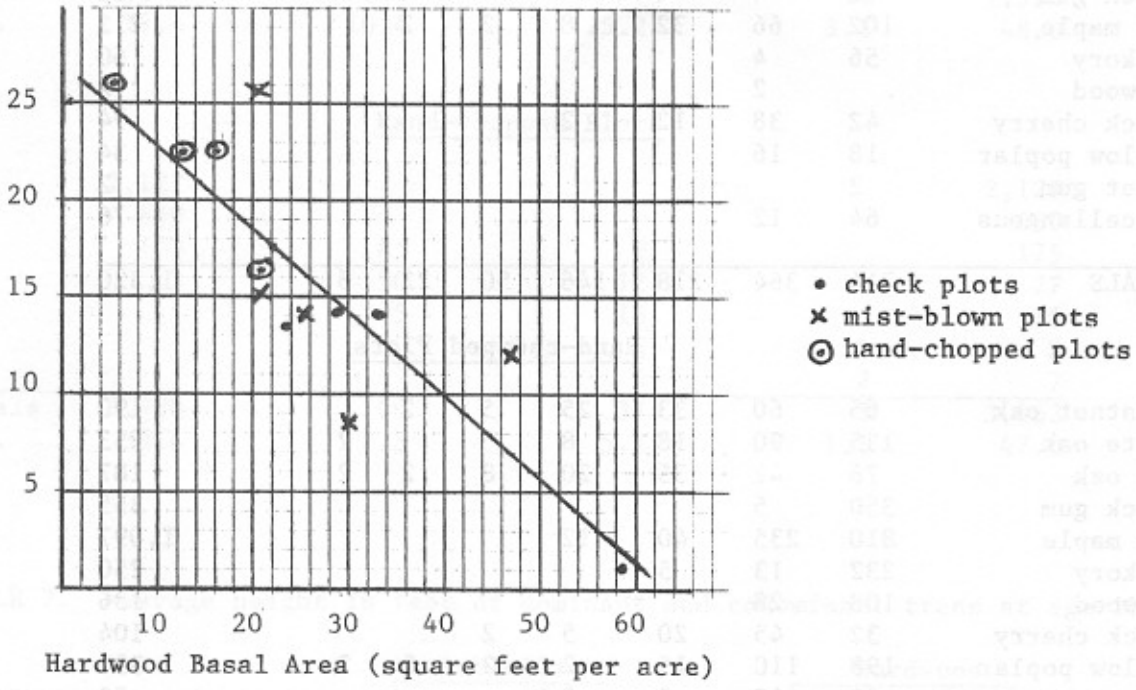

FIGURE 2. Pine cordwood yields at age 19 relative to basal area of intermediate, codominant and dominant hardwood trees.

1/ Estimated standard cords = 27.09 - .429 (Hardwood basal area), $r^2 = .745$

TABLE 5. Average numbers of hardwoods per acre by species and DBH class at age 19.

Species	DBH 1	2	3	4	5	6	7	8	Totals
Check Plots									
Chestnut oak	188	84	68	66	66	38	4	4	518
White oak	32	16	8	6		2			64
Red oak	120	42	24	24	18	4	2		234
Black gum	194	22	4						220
Red maple	216	78	40	12	4	2			352
Hickory	214	18	14	2					248
Dogwood	26	6	2						34
Black cherry	136	30	20	2					188
Yellow poplar	68	22	4						94
Sweet gum	2								2
Miscellaneous	26	4	2						32
TOTALS	1,222	322	186	112	88	46	6	4	1,986
Mist-blown Plots									
Chestnut oak	280	188	144	116	42	20	4		794
White oak	30	8	2	2					42
Red oak	48	26	24	18	6		2		124
Black gum	72	4	4						80
Red maple	102	66	32	8	2	2			212
Hickory	56	4							60
Dogwood		2							2
Black cherry	42	38	12	2					94
Yellow poplar	18	16							34
Sweet gum	2								2
Miscellaneous	64	12							76
TOTALS	714	364	218	146	50	22	6		1,520
Hand-chopped Plots									
Chestnut oak	65	60	33	25	5	2			190
White oak	135	90	18	8			2		253
Red oak	78	42	35	20	8	2	2		187
Black gum	350	5							355
Red maple	810	235	40	12					1,097
Hickory	232	13	5						250
Dogwood	108	28							136
Black cherry	32	45	20	5	2				104
Yellow poplar	198	110	15	2	2	2	2		331
Sweet gum	50	10	8	2					70
Miscellaneous	70	12	2	2					86
TOTALS	2,128	650	176	76	17	6	6		3,059

TABLE 6. Average numbers of hardwoods per acre by DBH class and crown class, and basal area by crown class, at age 19.

DBH	Over-topped	Intermediate	Codominant	Dominant	Totals
		Check Plots			
1	1,222				1,222
2	322				322
3	164	22			186
4	12	78	22		112
5	2	24	60	2	88
6		8	26	12	46
7				6	6
8				4	4
Totals	1,722	132	108	24	1,986
B.A.	23.1	12.7	15.2	5.6	56.6
		Mist-blown Plots			
1	714				714
2	364				364
3	132	84	2		218
4	12	72	62		146
5			48	2	50
6			16	6	22
7				6	6
Totals	1,222	156	128	14	1,520
B.A.	19.4	10.4	15.2	3.1	48.0
		Hand-chopped Plots			
1	2,127				2,127
2	650				650
3	128	45	2		175
4	15	50	12		77
5		5	13		18
6			5	3	8
7			5	2	7
Totals	2,920	100	37	5	3,062
B.A.	33.4	7.3	5.2	1.1	47.0

TABLE 7. Average height in feet of dominant and codominant trees at age 19.

Treatment	Loblolly		Hardwood	
	Mean	Range	Mean	Range
Check	48.8	44 to 54	45.0	39 to 50
Mist-blown	48.9	44 to 56	45.7	40 to 51
Hand-chopped	49.4	43 to 55	44.1	41 to 49

APPENDIX A. Loblolly pine data for each plot at the 10, 15, and 19 year measurements: number per acre, average DBH, basal area per acre, standard cords per acre, and average height of dominant and codominant trees.

	Check						Mist-blown						Hand-chopped					
Age	Plot	No.	DBH	BA	Cds.	Ht.	Plot	No.	DBH	BA	Cds.	Ht.	Plot	No.	DBH	BA	Cds.	Ht.
10	1	600	3.50	44.9	-	30.0	1	710	4.07	70.0	-	32.3	1	510	4.29	56.2	-	31.8
	2	380	3.42	27.6	-	28.7	2	670	3.42	48.3	-	30.0	2	500	4.30	54.3	-	30.1
	3	590	3.59	48.8	-	30.9	3	650	3.28	43.3	-	30.7	3	390	4.26	41.1	-	29.6
	4	660	3.41	49.1	-	31.4	4	700	2.86	36.2	-	31.0	4	620	4.35	70.4	-	32.3
	5	530	1.23	7.1	-	- /1/	5	540	3.56	42.1	-	31.4						
	Means	552	3.03	35.5	-	30.2	Means	654	3.44	48.0	-	31.1	Means	505	4.30	55.5	-	31.0
15	1	490	4.67	64.6	7.7	39.5	1	670	5.28	108.2	17.0	43.8	1	490	5.53	89.7	13.9	41.5
	2	310	5.23	50.2	6.9	40.8	2	510	4.80	67.7	8.7	42.1	2	460	5.91	93.0	14.4	42.2
	3	470	5.06	72.4	10.3	41.8	3	540	4.56	65.4	7.0	40.3	3	370	5.59	66.8	9.6	40.1
	4	550	4.65	71.0	8.8	41.5	4	520	4.00	50.3	4.7	39.7	4	600	5.55	110.7	16.4	42.7
	5	300	2.20	10.7	.4	- /1/	5	530	4.60	69.8	8.8	40.7						
	Means	424	4.36	53.8	6.8	40.9	Means	554	4.65	72.3	9.2	41.3	Means	480	5.64	90.0	13.6	41.6
19	1	440	5.43	77.7	14.0	48.2	1	630	5.89	126.7	25.6	51.5	1	440	6.34	105.4	22.3	51.5
	2	290	6.28	65.8	13.5	49.8	2	500	5.32	82.1	14.1	49.6	2	450	6.49	110.4	22.5	49.5
	3	420	6.02	89.7	17.7	48.9	3	490	5.08	74.0	12.0	47.8	3	370	6.30	85.1	16.4	47.5
	4	530	5.19	85.8	14.2	48.3	4	430	4.74	57.9	8.5	46.7	4	560	6.25	130.9	26.0	49.3
	5	250	2.56	12.8	1.1	- /1/	5	520	5.15	86.3	15.2	49.1						
	Means	386	5.10	66.4	12.1	48.8	Means	514	5.24	85.4	15.1	48.9	Means	455	6.34	108.0	21.8	49.4

/1/ No dominant or codominant pines on the plot